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**APPLICATION
FOR
UNITED STATES
LETTERS PATENT**

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FOR: SATELLITE COMMUNICATIONS DATA
DISTRIBUTION SYSTEM CAPABLE OF
PROVIDING A LOT OF DATA IN RESPONSE
TO A USER'S REQUEST

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SATELLITE COMMUNICATIONS DATA DISTRIBUTION SYSTEM
CAPABLE OF PROVIDING A LOT OF DATA
IN RESPONSE TO A USER'S REQUEST

Background of the Invention:

This invention relates to a satellite communication system for effectively carrying out data distribution using a wide-area characteristic, a broadcasting characteristic, and a broad-band characteristic in satellite communications.

In recent years, drastic growth has been observed in a system for carrying out data distribution using the Internet. Not only distribution of music or news, but also Internet schools or colleges for providing students with home education has been popular.

In the manner which will later be described in conjunction with Fig. 1, a conventional data distribution system comprises a plurality of members or subscribers, a plurality of data makers, the Internet serving as a ground communication network connected to the members and the data makers, and a data distribution center connected to the Internet. The data distribution center provides a home page (HP).

In addition, similar data distribution systems or broadcasting colleges using satellite communications are also widely used. For example, a Perfect PC is implemented as such a data distribution system using the satellite communications.

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With the enlargement of a business's area using the Internet, an amount of data transmitted drastically increases. Under the circumstances, large problems have been presented in the above-mentioned data distribution system as follows.

For example, although the data distribution system using the satellite communications usually uses a bandwidth of several megahelrts (MHz), a data communication capacity per person degrades justly when calls are congested.

A second problem is that communications are expensive. This is because the satellite communications are expensive naturally. In addition, inasmuch as the Internet transmits a signal via a number of routers, to transmit a lot of data takes data.

A third problem is that it is difficult to communicate in an interactive mode of a momentary fashion. This is because, in the manner which is described above, the Internet has a characteristic where data is always stored in a home page acting as a center and any user reads the data out of the home page via a communication line in necessary. In order to carrying out a seminar at the interactive mode of the momentary fashion, it is necessary to establish a telephone line between the subscriber or a receiver and the data maker or a sender and it is difficult to carry out this when the number of participants increases.

Summary of the Invention:

It is therefore an object of this invention to provide a satellite communication data distribution system which is

capable of providing a extremely number of users with a lot of data at low cost in a form corresponding to a request.

Other objects of this invention will become clear as the description proceeds.

The present inventor repeatedly studied as regards the reason why the above-mentioned problems occur in each of the conventional data distribution systems. In the manner which is described above, each of the conventional data distribution systems is the so-called instant getting system which instantly distributes data in response to a data request signal from a user. For example, in a case where the user orders an electronic book or books, it is possible in the user to instantly get a desired electronic book or books. However, in the manner which is described above, the instant getting system is disadvantageous in that it takes a long time to get the electronic book if a circuit is congested and it is expensive because the user must pay a communication fee alone.

Accordingly, in a case, for example, where a user orders an electronic book or books, the present inventor reached to an idea that the above-mentioned problems are resolved if there are not only a choice so as to enable to instantly get the electronic book or books but also another choice so as to enable to order the electronic book or books by designating or setting a term such as one day, one week, or the like or with a time limit. That is, if any user can order any electronic book with the time limit, a desired electronic book may be simultaneously distributed to a plurality of users via a satellite at it's designated time instant in a case where other users already ordered the same

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electronic book. As a result, a communication fee per person is not expensive. In the manner which is described above, this invention effectively uses a satellite channel in a subscription fashion. Inasmuch as satellite communications cover an enlarged area, it may be expected that almost books may be ordered by a number of users for one day or one week. In such a case, this invention is extremely effective.

More specifically, according to an aspect of this invention, a data distribution system comprises a communication satellite, a plurality of satellite communication terminals for enabling to receive a signal from the communication satellite, a satellite earth station for carrying out a principal communication via the communication satellite, a data distribution center connected to the satellite earth station via a communication channel, and a data communication network for connecting the data distribution center with a database in order to collecting information. The data distribution center includes an electronic library for storing collected information in an electronic fashion and for presenting its contents to users of the satellite communication terminals for retrieval. Responsive to a data request signal from a user, the electronic library provides required information. Each satellite communication terminal comprises an arrangement for transmitting the data request signal with a time limit to the data distribution center. Responsive to the data request signal with the time limit from each satellite communication terminal, the data distribution center comprises an arrangement for distributing desired data to a plurality of satellite

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In addition, the above-mentioned data distribution system may further comprise a ground communication network for connecting the data distribution center and each satellite communication terminal. In addition, the above-mentioned data communication network may be the Internet.

Fig. 1 is a block diagram of a conventional distribution system using the Internet;

Fig. 3 is a block diagram of a subscriber's terminal according to this invention that may serve also as a satellite broadcast reception equipment;

Fig. 4 is a block diagram of, as a subscriber's terminal for use in the system according to this invention, a two-way satellite communication terminal which may serve also as a VSAT terminal;

Fig. 5 is a block diagram of a satellite earth station and a data distribution center which are the key point of the system according to this invention;

Fig. 6 is a flow chart for use in describing a data distribution method according to this invention;

Fig. 7 is a flow chart for use in describing a data distribution step in Fig. 6 in more detail;

Fig. 8 is a flow chart for use in describing a reception operation in each subscriber's terminal in the satellite communications data distribution system illustrated in Fig. 2; and

Fig. 9 is a flow chart for use in describing a step for returning a reservation signal in Fig. 7 in more detail.

Description of the Preferred Embodiments:

(Operations of the Invention)

Description will at first be directed to operations of this invention to facilitate an understanding of this invention.

(1) Merits of satellite communications

Satellite communications can provide a communication network at once at an enlarged area of about one third of an earth's surface by using one satellite. Merits of the satellite communications in a going or outgoing communication are broadcast as well as wide-area or global. The satellite communications are specifically suitable for broadcasting and are presently commercialized as a direct satellite broadcasting.

In recent years, inasmuch as a communication satellite is loaded with an antenna having a large caliber or diameter and has a drastic increased output power, a large-capacity communication is available. Simultaneously, the communication satellite has a particularly improved reception sensitivity and communication at a fair high-speed is available in a returning or incoming communication where a small satellite communication terminal for a subscriber transmits. Accordingly, broadband as well as the wide-area and the broadcast are strengthened as the

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(2) Problems in the Internet

(3) solution using a satellite

As a method of raising the channel capacity of the above-mentioned backbone, a business is starting which periodically downloads data using the satellite to each of positions of internet service providers (ISPs). Each ISP stores

(4) Practical use of communication resources

(5) Practical use of multimedia techniques

Education is exemplified. A broadcast college carried out presently uses television channels. The television channels are quite insufficient as regular education and available frequency resources are limited. As a result, channel assignments over this are not expected.

However, if contents of lectures are investigated minutely, it is apparent that it is possible to broadcast lectures two or more times by using a current television band. By using a current signal processing technique, it is possible to drastically decrease a required band width due to image compression and speech compression. For instance, it is possible to decrease the required band width up to about 8 Kbps and about 300 Kbps in connection with a speech and a moving image

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the data storage, it is possible to distribute thousands of lectures per day. Accordingly, it is possible to provide learning programs having higher freedom to the subscribers in a broad range in a grand area.

In general, it is increasingly necessary to store not only data updated day by day such as education but also a lot of data which is not updated such as a library. When a small office home office (SOHO) where a work is done at home spreads hereafter, various technical materials and market information necessitate more and more. Its characteristic is that an amount of data becomes huge and the Internet is disadvantageous in that a communication time and fee become larger due to the above-mentioned reasons. On the other hand, the satellite communications are extremely effective to temporarily distribute a lot of data to a number of persons.

(7) Flexible time service

A further characteristic in the satellite communications enables not only communication of a store-type but also communication of an instant-type. This is because data distribution is performed in the ground communication network for the destination via several routers while the data is distributed in the satellite communications to the destination by only one relay. Inasmuch as this corresponds to immediately read the stored data on reception of a request for the stored data, it is possible to realize this by using the stored-type as it is on the signal processing.

(8) Satellite communications data distribution center serving as a temporary storage position of the Internet

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(Prior art)

Referring to Fig. 1, description will be made as regards operation of the conventional data distribution system.

Each data maker or data sender 60 prepares information to be sent to publish the information on the home page (which will be hereinafter called "HP" for short) of the data distribution center 80 serving as a position where the Internet provider or enterpriser provides. On the other hand, each member or user 50' connects to the data distribution center 80 via the Internet 70 and reads a predetermined data from the data distribution center 80 to use it. The user 50 inputs questions,

In the manner which is described above, the data senders 60 and the users 50' can prepare and use information at his or her convenience. In addition, the user may be connected to the Internet 70 irrespective to a position. Inasmuch as the Internet 70 has a high degree of freedom without any temporal and spatial restriction, it is possible to easily construct an interactive information system due to two-way communication. In addition, the information is not restricted to a letter, it is possible to use various types of information such as a picture (painting), an image, a voice, or the like. In the manner which is described above, the Internet 70 is a really epoch-making information communication system and abruptly grows up.

(Embodiment)

Referring to Fig. 2, the description will proceed to a satellite communications data distribution system according to an embodiment of this invention. The illustrated satellite communications data distribution system comprises a communication satellite 10, a satellite earth station 20, and a data distribution center 30. The satellite earth station 20 carries out communication between the communication satellite 10 and the satellite earth station 20. In addition, the

satellite earth station 20 is connected to the data distribution center 30. Hereinafter, a combination of the satellite earth station 20 and the data distribution center 30 is called a data center.

The satellite communications data distribution system further comprises a plurality of subscriber's terminals 40 and 50, a plurality of information originators or senders 60, and a ground communication network 70. The subscriber's terminals are classified into first-type subscriber's terminals 40 and second-type subscriber's terminals 50. Each first-type subscriber's terminal 40 is a two-way satellite communicatable subscriber's terminal which can not only receive a signal via the communication satellite 10 but also transmit a signal via the communication satellite 10. On the other hand, each second-type subscriber's terminal 50 is a reception exclusive subscriber's terminal which can receive a signal from the communication satellite 10 but cannot transmit a signal. Each second-type subscriber's terminal 50 is connected to the ground communication network 70. Each information sender 60 may be, for example, an editor for an home page of the Internet or an electronic book publisher. Each information sender 60 is connected to the data distribution center 30 via the ground communication network 70. The ground communication network 70 may be, for example, a communication network for telephones and facsimiles, the Internet, or the like.

In the manner which is illustrated in Fig. 2, the data distribution center 30 carries out satellite communications to all of the subscriber's terminals 40, 50 via the satellite earth

station 20 and the communication satellite 10. In addition, the data distribution center 30 has a communication function such as a telephone, a facsimile, a mail-box, an E-mail, or the like to the second-type subscriber's terminal 50 via the ground communication network 70 but also another communication function such as file transfer to the information sender 60 via the ground communication network 70 or satellite communications. The data distribution center 30 is a central component part of the system according to this invention.

Turning to Fig. 3, the description will proceed to the second-type subscriber's terminal 50 illustrated in Fig. 2. The second-type subscriber's terminal 50 comprises a satellite communications reception antenna and connection circuit (which will later be called "ANT connection circuit") 51, a connection cable 52, a receiving unit 53, a selection circuit 54, a set-top box (which will later be called "STB") 55, and a television (TV) display circuit 56.

The ANT connection circuit 51 is connected to the receiving unit 53 through the connection cable 52. The receiving unit 53 is connected to the selection circuit 54. The selection circuit 54 is connected to the STB 55. The STB 55 is connected to the TV display circuit 56.

The receiving unit 53 carries out amplification and demodulation on a received signal. The selection circuit 54 selects, as a selected signal, a signal addressed to the subscriber in question from the received signal. The STB 55 stores the selected signal and carries out reproduction of an image and a voice in accordance with an operation of the

subscriber. Responsive to a signal from the STB 55, the TV display circuit 56 displays the image and the voice.

An equipment illustrated in Fig. 3 may be implemented by using most of a current commercialized direct satellite broadcast (DSB) equipment as it is. In this event, in general, the ANT connection circuit 54 is set up outdoor while others except for the ANT connection circuit 54 is set up indoor. A combination of the STB 55 and the TV display circuit 56 may be operable as a normal reception display unit for satellite broadcasting by operations of the subscriber and may be a terminal for a satellite communication educational institution or school with which the system according to this invention provides.

Turning to Fig. 4, the description will proceed to the first-type subscriber's terminal 40 illustrated in Fig. 2. The first-type subscriber's terminal 40 comprises a satellite communications reception antenna and connection circuit (which will later be called "ANT connection circuit") 41 which enables to not only receive but also transmit, a connection cable 42, and a branching filter or a channel multiplexer 43 for separating a transmission signal and the received signal. The ANT connection circuit 41 is connected to the branching filter 43 through the connection cable 42.

The first-type subscriber's terminal 40 further comprises an information terminal 46 such as a personal computer (which may be called "PC" for short) or the like, a transmission signal generating circuit 45, and a modulating and transmitting unit 44. The information terminal 46 is connected to the transmission signal generating circuit 45. The transmission signal

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The information terminal 46 prepares a signal to supply a prepared signal to the transmission signal generating circuit 45. Responsive to the prepared signal, the transmission signal generating circuit 45 generates the transmission signal of a predetermined transmission signal format to supply the transmission signal to the modulating and transmitting unit 44. Responsive to the transmission signal, the modulating and transmitting unit 44 modulates a carrier signal with the transmission signal in a predetermined system to produce a modulated signal, sets a frequency for the modulated signal, and amplifies a modulated signal into an amplified modulated signal. The amplified modulated signal is sent to the ANT connection circuit 41 through the branching filter 43 and the connection cable 42.

In a similar manner as the second-type subscriber's terminal 50 illustrated in Fig. 3, the first-type subscriber's terminal 40 further comprises the receiving unit 53, the selection circuit 54, the STB 55, and the TV display circuit 56. The STB 55 is connected to the information terminal 46.

In the manner as apparent by comparing Fig. 4 with Fig. 3, the first-type subscriber's terminal 40 comprises a receiving portion which enables to serve the direct satellite broadcast reception equipment and a transmitting portion which enables to serve a terminal equipment for a very small aperture terminal (VSAT) system.

On the other hand, the data distribution center 30 comprises a satellite network connection circuit 31 for receiving a signal from the satellite earth station 20, a ground network connection circuit 32 for carrying out a transmission and reception connection to the ground communication network 70 (Fig. 2) for telephones, facsimiles, file transfers, and E-mails, a transmission data preparing unit 33, a data transmitting unit 34, and an information storage unit 35. The satellite network connection circuit 31 is connected to the selection circuit 24 and to the transmission data preparing unit 33. The ground network connection circuit 32 is connected to the transmission data preparing unit 33 and to the ground communication network 70 (Fig. 2). The data transmitting unit 34 is connected to the transmission signal generating circuit 25 and to the transmission data preparing unit 33. The information storage

Responsive to a data request signal received from the subscriber via the satellite network connection circuit 31 or the ground network connection circuit 32, the transmission data preparing unit 33 prepares a series of data to be transmitted to the communication satellite 10 (Fig. 2). The data transmitting unit 34 reads, in accordance with a satellite system time, transmission data from the transmission data preparing unit 33, generates the transmission data in a broadcasting fashion, and sends the transmission data to the satellite earth station 20. The information storage unit 35 is a unit for storing a lot of information in a form of a compact disc (CD), a hard disk (HD), a magnetic tape, a redundant array of inexpensive disks (RAID), and so on. The information storage unit 35 may be an electronic library. The electronic library 35 may exchange and collect information to and from the subscribers via the satellite network connection circuit 31 or the ground network connection circuit 32 or general users via the Internet and may store the information therein.

The satellite communications data distribution system according to this invention can resolve the problems in the above-mentioned conventional data distribution system using the Internet (Fig. 1).

More specifically, the satellite communications data distribution system according to this invention has a good efficiency because the satellite communications data distribution system according to this invention distributes the data using the broadcasting of the satellite. Inasmuch as each

of the subscriber's terminals 40, 50 may be used also as the direct satellite broadcasting reception terminal, each subscriber's terminal is not expensive. Particularly, if the data distribution is carried out at midnight when a number of broadcasting channels stop to transmit, the communication fee is not expensive. The rent of a satellite channel having a bit rate of about 10 Mb/s is about twenty thousands yen per hour. It takes about ten seconds to distribute the above-mentioned teaching material having a data capacity of 10 MBytes using this channel. Cost required to this is not more than one hundred yen and then cost per person becomes not more than one yen if the subscriber's receiving a subject for the teaching material are equal in number to one hundred. Inasmuch as the number of subjects enable to distribute for one hour are not less than three hundreds, it is possible to distribute the teaching materials of thousands of special subjects by using time band of the midnight. In comparison with the current broadcast collage, it is possible to increase the number of the special subjects by hundreds of times.

In the manner as apparent from the above description, the data distribution using the satellite communications has a higher efficiency when the number of the users simultaneously receiving the data is many. Although a satellite Internet system which immediately replies to a user's request is practically used, such a satellite Internet system is expensive compared with the Internet in an especial case of carrying out distribution of a lot of data for one user.

However, utilization mode in the user is really multifarious. In the information storage unit 35, various types are stored that are, for example, those which may be reached within several days after an order such as the complete works of Japanese literary or a textbook of algebraic geometry, those which may be updated once a day such as a daily newspaper, those which may be updated once several hours such as a weather forecast, and those in which instant response may be required such as a reservation condition of a means of transportation.

As shown in Fig. 6, the information storage unit or the electronic library 35 stores various information such as books of electronic format, reports of electronic format, a bulletin board system (BBS), or the like and publishes a list of those contents or a table of contents on the home page of the data

distribution center 30 at a step S11.

The step S11 is followed by a step S12 at which each user connects with the home page of the data distribution center 30 to retrieve available information. If necessary information exists on the home page, the step S12 proceeds to a step S13 at which the user transmits, to the data distribution center 30, a data request signal with a time limit that will later be described. For example, the user clicks a predetermined position on a screen of the home page.

At the step S13, the data request signal with the time limit is assigned with an allowable waiting time interval until its information is delivered with ID of a requester. The data request signal with the time limit has classes such as instant, within ten minutes, within thirty minutes, within one hour, within six hours, within one day, within three days, periodically, or the like. In a case where the data request signal requests the instant, the requester makes the data request signal include an encipher key.

When the data request signal with the time limit is received in the data distribution center 30, the step S13 is succeeded by a step S14 at which the data distribution center 30 distributes data via the satellite earth station 20 and the communication satellite 10 within the allowable waiting time interval in the manner which will presently be described.

Turning to Fig. 7, the data distribution center 30 determines whether or not the data request signal indicates the instant at a step S21. When the data request signal indicates the instant, the step S21 is followed by a step S22 at which the

data distribution center 30 distributes requested data via the communication satellite 10 as soon as possible. In this event, the request data is enciphered using the encipher key designated by the request source.

When the allowable waiting time interval included in the data request signal is not the instant, the step S21 proceeds to a step S23 at which the data distribution center 30 first returns a reservation signal to the request source via the communication satellite 10. Contents of the reservation signal include a request source's ID, a reservation number (a group address), and a distribution scheduled time instant.

When the subscriber's terminals 40, 50 receive the reservation signal, the step S23 is succeeded by a step S24 at which each subscriber's terminal sets the group address and the distribution scheduled time instant which are assigned with its own satellite reception equipment and is put into a reception waiting state. Simultaneously, the subscriber's terminals 40, 50 return a reservation confirmation signal to the data distribution center 30 via the Internet 70 or the communication satellite 10 at a step S25. The reservation confirmation signal includes the request source's ID, an assigned group address, and a request source's encipher key.

When the reservation confirmation signal is received in the data distribution center 30, the step S25 is followed by a step S26 at which the data distribution center 30 distributes, to the request sources or the users, a decipher key distribution signal indicative of a decipher key for distribution data. The decipher key distribution signal is distributed via the ground

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Referring now to Fig. 8, description will be made as regards the reception operation in each of the subscriber's terminals 40 and 50. In the manner which is described above, the data with the above-mentioned is broadcasted from the data distribution center 30 via the communication satellite 10 at the distribution scheduled time instant. Each of the subscriber's terminals 40 and 50 receives the data including the group address assigned with its own station at a designated time instant at a step S31. The step S31 is followed by a step S32 at which each of the subscriber's terminals 40 and 50 deciphers the received data using the data decipher key to produce deciphered data. The step S32 proceeds to a step S33 at which each of the subscriber's terminals 40 and 50 stores the deciphered data in a memory (not shown).

The data distribution center 30 confirms in a monitoring satellite reception equipment (not shown) established therein that the data is rightly received and gives a receipt for the

user. When payment is made, the transaction comes to an end.

A key according to this invention is a method of determining the above-mentioned distribution time instant. This determining method is performed by the transmission data preparing unit 33 illustrated in Fig. 5.

Referring now to Fig. 9 in addition to Fig. 7, the description will proceed to a basic way regarding the determining method.

When the data request signal indicates the instant, the data distribution center 30 distributes data as soon as possible (the step S22 in Fig. 7). When the data request signal does not indicate the instant, the step S21 is followed by a step S41 at which the transmission data preparing unit 33 distributes determines whether or not the allowable waiting time interval or a requested emergency level is not less than a predetermined time interval T. When the requested emergency level is not less than the predetermined time interval T, the step S41 proceeds to a step S42 at which the transmission data preparing unit 33 checks whether or not reservation for the same data is already present. When the reservation is absent, the step S42 is succeeded by a step S43 at which the transmission data preparing unit 33 reserves distribution for this data, selects a new group address, prepares a reservation signal in the manner which is described above, and returns the reservation signal to the requester via the communication satellite 10. When the reservation is already present, the step S42 is followed by a step S44 at which the transmission data preparing unit 33 returns the reservation signal including the reserved time instant and

A first effect is that it is possible to distribute a large quantity of data to a lot of users in a broad area in very simple structure at a low cost. This is because it is possible for the system according to this invention to use together with the existing direct satellite broadcasting reception equipment, it is therefore possible to easily implement the subscriber's terminal at a low cost, and it is possible to carry out data transfer once a number of persons in a reservation fashion. In addition, it is possible to directly carry out data distribution to users by only one relay via the satellite and the system according to this invention has a high transmission efficiency because it is unnecessary to divide the data into a lot of datagrams in the manner as the Internet.

While this invention has thus far been described in conjunction with a preferred embodiment thereof, it will now be readily possible for those skilled in the art to put this invention into various other manners. For example,

While this invention has thus far been described in conjunction with a preferred embodiment thereof, it will now be readily possible for those skilled in the art to put this invention into various other manners. For example,